# M.Sc. (Computer Science) Syllabus

## M. Sc. Computer Science - First Year

<table>
<thead>
<tr>
<th>Paper &amp; Section</th>
<th>Subject</th>
<th>Lect / Week</th>
<th>Pract / Week</th>
<th>Theory Paper Hours</th>
<th>Marks</th>
<th>Practical Hours</th>
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## M. Sc. Computer Science - Second Year

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<tr>
<th>Paper &amp; Section</th>
<th>Subject</th>
<th>Lect / Week</th>
<th>Pract / Week</th>
<th>Theory Paper Hours</th>
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## Elective - I

| 1               | Parallel Processing                    |
| 2               | Advanced Computer Networks            |
| 3               | System Security                       |
| 4               | Internet security                     |
| 5               | Enterprise Networking                 |
| 6               | Satellite Communications               |
| 7               | Fuzzy Logic & Neural networks         |
| 8               | Multimedia systems & convergence of technologies |

## Elective - II

| 1               | Pattern Recognition                   |
| 2               | Computer Vision                      |
| 3               | Virtual Reality & Virtual Environment |
| 4               | Java Technology                      |
| 5               | Bio Informatics                      |
| 6               | Intelligent Systems                  |
| 7               | Optimization Techniques              |
| 8               | Customer Relations Management        |
Term I

- **Introduction to Compilers**
  - Compilers and translators
  - Why do we need translators?
  - The structure of a compiler
  - Lexical analysis
  - Syntax analysis
  - Intermediate code generation
  - Optimization
  - Code generation
  - Book keeping
  - Error handling
  - Compiler writing tools
  - Getting started

- **Programming languages**
  - High-level programming languages
  - Definitions of programming languages
  - The lexical and syntactic structure of a language
  - Data elements
  - Data structures
  - Operators
  - Assignment
  - Statements
  - Program units
  - Data environments
  - Parameter transmission
  - Storage management

- **Finite automata and lexical analysis**
  - The role of the lexical analyzer
  - A simple approach to the design of lexical analyzers
  - Regular expressions
  - Finite automata
  - From regular expressions to finite automata
  - Minimizing the number of states of a DFA
  - A language for specifying lexical analyzers
  - Implementation of a lexical analyzer
  - The scanner generator as Swiss army knife

- **The syntactic specification of Programming Languages**
  - Context-free grammars
  - Derivations and parse trees
  - Capabilities of context-free grammars

- **Basic Parsing Techniques**
  - Parsers
  - Shift-reduce parsing
  - Operator-precedence parsing
  - Top-down parsing
  - Predictive parsers

- **Automatic Construction of Efficient Parsers**
- LR parsers
- The canonical collection of LR(0) items
- Constructing SLR parsing tables
- Constructing canonical LR parsing tables
- Constructing LALR parsing tables
- Using ambiguous grammars
- An automatic parser generator
- Implementation of LR parsing tables
- Constructing LALR sets of items

**SUBJECT: PRINCIPLES OF COMPILER DESIGN, Paper I, Term II**

- Syntax-Directed Translation
  - Syntax-directed translation schemes
  - Implementation of syntax-directed translators
  - Intermediate code
  - Postfix notation
  - Parse trees and syntax trees
  - Three-address code, quadruples, and triples
  - Translation of assignment statements
  - Boolean expressions
  - Statements that alter the flow of control
  - Postfix translations
  - Translation with a top-down parser

- More about Translation
  - Array references in arithmetic expressions
  - Procedure calls
  - Declarations
  - Case statements
  - Record structures
  - PL/I-style structures

- Symbol Tables
  - The contents of a symbol table
  - Data structures for symbol tables
  - Representing scope information

- Symbol tables
  - Implementation of a simple stack allocation scheme
  - Implementation of block-structured languages
  - Storage allocation in FORTRAN
  - Storage allocation in block-structured languages

- Error detection and recovery
  - Errors
  - Lexical-phase errors
  - Syntactic-phase errors
  - Semantic errors

- Introduction to code optimization
  - The principle sources of optimization
  - Loop optimization
  - The DAG representation of basic blocks
  - Value numbers and algebraic laws
  - Global data-flow analysis

- More about loop optimization
  - Dominators
  - Reducible flow graphs
  - Depth-first search
  - Loop-invariant computations
  - Induction variable elimination
  - Some other loop optimizations

- More about data-flow analysis
Reaching definitions again
Available expressions
Copy propagation
Backward flow problems
Very busy expressions and code hoisting
The four kinds of data-flow analysis problems
Handling pointers
Interprocedural data-flow analysis
Putting it all together

Code generation
Object programs
Problems in code generation
A machine model
A simple code generator
Register allocation and assignment
Code generation from DAG’s
Peephole optimization

Practical

- Debug C++ / JAVA Programs using debugger provided by different vendors along with IDE
- Make a comparative study of Different features of at least two Integrated Development Environment (IDE) and compilers
- Manipulation of IDE’s and restoring the original setting

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<thead>
<tr>
<th>CLASS: M. Sc (Computer Science)</th>
<th>Year I</th>
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<tbody>
<tr>
<td>SUBJECT: Digital Signal Processing, Paper II, Term I</td>
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<tr>
<td><strong>Periods per week</strong></td>
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<td><strong>Evaluation System</strong></td>
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<td><strong>TW/Practical</strong> -- 50</td>
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Paper II, Term I


Finite word length effects in digital filters-analog to digital conversions-digital to analog conversions-types of Arithmetic in digital systems. Types of quantization in digital filters-Dynamic range
Constraints-Realizations-ordering and pairing in cascade realizations-round of noise-fixed point analysis-Coefficient quantization – Limit cycle oscillations

Spectrum analysis and the fast fourier Transform-introduction to Radix-2 FFT’s-data shuffling and bit reversal-FFT computer programming-Decimation –in-Frequency Algorithm –Computing an Inverse DFT by doing a Direct DFT-Radix2 Algorithm-Spectrum analysis at a single point in the z plane-spectrum analysis in FFT Analysis-Windows in spectrum Analysis-Bluestein’s Algorithm-The chirp z transform algorithm- convolution and correlation using number theoretic transforms.

Paper II, Term II

An introduction to the theory of two dimensional signal processing-Two-dimensional signals-systems-causality- seperability -stability-difference equations-Frequency Domain Techniques- Z Transforms-finite sequences-Two dimensional DFT-Two dimensional windows-Frequency sampling filters- frequency transformations from one to two dimensions.

Introduction to Digital hardware-design procedure for Digital Signal Processing Hardware- the major logic families- commercial logic packages- gates, multiplexers and decoders- Flip-Flops-arithmetic Units- dividers and floating point hardware.
Special purpose hardware for digital filtering and signal generation-direct form FIR hardware-parallelism for direct form FIR- Cascade FIR filters-IIR filters- Digital Touch Tone Receiver (TTR) - Digital time Division Multiplexing (TDM) to Frequency Division Multiplexing (FDM) translator partitioning of digital filters for IC Realization- Hardware realization of a Digital Frequency Synthesizer

Special purpose hardware for FFT- FFT indexing- bit reversal and digit reversal for fixed radices-Comparison of computations for radices- introduction to quantization effects in FFT Algorithms.
Hardware for Radix 2 Algorithm- FFT Computation using Fast Scratch Memory
Radix 2 and Radix 4 Parallel structures using RAM’s- Pipeline FFT- Comparison of Pipe line FFT’s-overlapped FFT with random access memory-real time convolution via FFT using a single Ram and one AE

General Purpose hardware for signal Processing facilities- special and general purpose computers-input output problems for real time processing- methods of improving computer speed – parallel operations of memories, Arithmetic, control and instruction fetches- the Linco Laboratory Fast Digital Processor(FDP). Doing FFT in FDP- LSP2

Application of Digital signal processing to speech- models of speech production-Short time spectrum analysis- speech analysis-synthesis System based on short time spectrum analysis- channel vocoder-analyzers-synthesizers- pitch detection and voiced unvoiced detections- homomorphic processing of speech, vocoder-formant Synthesis- Voiced –Unvoiced Detection- Voiced Fricative excitation

network- Linear prediction of speech- Computer Voice Response system

Reference
Theory and application of Digital signal processing Lawrence R. Rabiner Bernard Gold- prentice hall of India
Practical
Hands on experience in using commercial software packages for digital signal processing
Developing academic exercise programs for Filter design and FFT analysis for real time applications

<table>
<thead>
<tr>
<th>CLASS: M. Sc (Computer Science)</th>
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<tbody>
<tr>
<td>SUBJECT: MOBILE COMPUTING, Paper III, Term I</td>
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<tr>
<td>Lectures: 4 Hrs per week</td>
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<td>Theory: 75 Marks</td>
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Objective: Recent developments in portable devices and high-bandwidth, ubiquitous wireless networks has made mobile computing a reality. Indeed, it is widely predicted that within the next
few years’ access to Internet services will be primarily from wireless devices, with desktop browsing the exception. Such predictions are based on the huge growth in the wireless phone market and the success of wireless data services. This course will help in understanding fundamental concepts, current developments in mobile communication systems and wireless computer networks.

### DETAILED SYLLABUS

1. **Introduction:** Applications, A short history of wireless communication
2. **Wireless Transmission:** Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems.
3. **Medium Access Control:** Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.
5. **Satellite Systems:** History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover, Examples
6. **Broadcast Systems:** Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting
8. **Wireless ATM:** Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN; Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol
10. **Mobile Transport Layer:** Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP

**Text Books:**
1. Jochen Schiller, “Mobile communications”, Addison wisely, Pearson Education
2. William Stallings, “Wireless Communications and Networks”

**References:**
1. Rappaort, “Wireless Communications Principals and Practices”

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF MUMBAI

CLASS: M. Sc (Computer Science)

SUBJECT: COMPUTER SIMULATION AND MODELING, Paper III, Term II

<table>
<thead>
<tr>
<th>Lectures: 4 Hrs per week</th>
<th>Practical: 4 Hrs per week</th>
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<tr>
<td>Term work / Practical: 50 Marks</td>
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Objective: In the last five decades digital computer simulation has developed from infancy to a full-fledged discipline. The field of modeling and simulation is as diverse as of man. The application of simulation continues to expand, both in terms of extent to which simulation is used and the range of applications. This course gives a comprehensive and state of art treatment of all the important aspects of a simulation study, including modeling, simulation software, model verification and validation, input modeling.

DETAILED SYLLABUS

1. **Introduction to Simulation**: System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation.
2. **Simulation Examples**: Simulation of Queueing systems, Other examples of simulation.
3. **General Principles**: Concepts of discrete event simulation, List processing.
6. **Queueing Models**: Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Steady state behavior of infinite population Markovian models, Steady state behavior finite population model, Network of Queues.
9. **Input Modeling**: Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.
10. **Verification and Validation of Simulation Model**: Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models.
11. **Output Analysis for a Single Model**: Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation.
12. **Comparison and Evaluation of Alternative System Design**: Comparison of two system design, Comparison of several system design, Meta modeling, Optimization via simulation.
13. **Case Studies**: Simulation of manufacturing systems, Simulation of computer systems, Simulation of super market, Simulation of pert network.

Text Books:


References:


TERM WORK

1. Term work should consist of at least 10 practical experiments/Assignments covering the topics of the syllabus.
Objectives of the course: The data warehousing part of module aims to give students a good overview of the ideas and techniques which are behind recent development in the data warehousing and online analytical processing (OLAP) fields, in terms of data models, query language, conceptual design methodologies, and storage techniques. Data mining part of the model aims to motivate, define and characterize data mining as process; to motivate, define and characterize data mining applications.

DETAILED SYLLABUS

Data Warehousing:
2. Planning And Requirements: Project planning and management, Collecting the requirements.
4. Data Design And Data Representation: Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.
5. Information Access And Delivery: Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.

Data Mining:
1. Introduction: Basics of data mining, related concepts, Data mining techniques.
2. Data Mining Algorithms: Classification, Clustering, Association rules.
3. Knowledge Discovery: KDD Process
5. Advanced Topics: Spatial mining, Temporal mining.
6. Visualisation: Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, Mining class comparisons: Discriminating between different classes, Mining descriptive statistical measures in large databases
7. Data Mining Primitives, Languages, and System Architectures: Data mining primitives, Query language, Designing GUI based on a data mining query language, Architectures of data mining systems

Text Books:
2. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education.
3. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann

References:
5. E.G. Mallach, “Decision Support and Data Warehouse systems”, TMH.

TERM WORK
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
CLASS: M. Sc (Computer Science)

SUBJECT: ADVANCED DATABASE SYSTEMS, Paper IV, Term II

Lectures: 4 Hrs per week  
Practical: 4 Hrs per week  
Theory: 75 Marks  
Term work / Practical: 50 Marks

Objectives: To study the further database techniques beyond which covered in the second year, and thus to acquaint the students with some relatively advanced issues. At the end of the course students should be able to: gain an awareness of the basic issues in object-oriented data models, learn about the Web-DBMS integration technology and XML for Internet database applications, familiarize with the data-warehousing and data-mining techniques and other advanced topics, apply the knowledge acquired to solve simple problems.

DETAILED SYLLABUS

1. The Extended Entity Relationship Model and Object Model: The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.

2. Object-Oriented Databases: Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS

3. Object Relational and Extended Relational Databases: Database design for an ORDBMS - Nested relations and collections; Storage and access methods, Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; Systems comparison of RDBMS, OODBMS, ORDBMS

4. Parallel and Distributed Databases and Client-Server Architecture: Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture

5. Databases on the Web and Semi-Structured Data: Web interfaces to the Web, Overview of XML; Structure of XML data, Document schema, Querying XML data; Storage of XML data, XML applications; The semi structured data model, Implementation issues, Indexes for text data

6. Enhanced Data Models for Advanced Applications: Active database concepts. Temporal database concepts.; Spatial databases, Concepts and architecture; Deductive databases and Query processing; Mobile databases, Geographic information systems.

Text Books:

References:

TERM WORK

1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
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<tr>
<th>CLASS: M. Sc (Computer Science)</th>
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<tr>
<td>SUBJECT: PARALLEL PROCESSING (Elective-I)</td>
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<td>Lectures: 4 Hrs per week</td>
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<td><strong>Objective:</strong> Upon completion of this course students will be able to understand and employ the fundamental concepts and mechanisms which form the basis of the design of parallel computation models and algorithms, recognize problems and limitations to parallel systems, as well as possible solutions.</td>
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**DETAILED SYLLABUS**
1. **Introduction:** Parallel Processing Architectures: Parallelism in sequential machines, Abstract model of parallel computer, Multiprocessor architecture, Pipelining, Array processors.
2. **Programmability Issues:** An overview, Operating system support, Types of operating systems, Parallel programming models, Software tools.
3. **Data Dependency Analysis:** Types of dependencies loop and array dependences, Loop dependence analysis, Solving diophantine equations, Program transformations.
4. **Shared Memory Programming:** General model of shared memory programming, Process model under UNIX.
5. **Algorithms for Parallel Machines:** Speedup, Complexity and cost, Histogram computation, Parallel reduction, Quadrature problem, Matrix multiplication, Parallel sorting algorithms, Solving linear systems, Probabilistic algorithms.
7. **Parallel Programming languages:** Fortran90, nCUBE C, Occam, C-Linda.
8. **Debugging Parallel Programs:** Debugging techniques, Debugging message passing parallel programs, Debugging shared memory parallel programs.
9. **Memory and I/O Subsystems:** Hierarchical memory structure, Virtual memory system, Memory allocation and management, Cache allocation and management, Cache memories and management, Input output subsystems.
10. **Other Parallelism Paradigms:** Data flow computing, Systolic architectures, Functional and logic paradigms, Distributed shared memory.
11. **Performance of Parallel Processors:** Speedup and efficiency, Amdahl’s law, Gustafson-Barsis’s law, Karf-Flatt metric, Isoefficiency metric.

**Text Books:**
3. M.J. Quinn, “Parallel Programming”, TMH.

**References:**
1. Shasikumar M., “Introduction to Parallel Processing”, PHI.
2. Wilson G.V., “Practical Parallel Programming”, PHI.

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

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<table>
<thead>
<tr>
<th>CLASS: M. Sc (Computer Science)</th>
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<tbody>
<tr>
<td>SUBJECT: ADVANCED COMPUTER NETWORKS (Elective-I)</td>
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<tr>
<td>Lectures: 4 Hrs per week</td>
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<td><strong>Objectives:</strong> In first part, Advanced technologies like High speed Devices etc. are to be considered. Second part Network programming is to be studied. Not just SOCKETS but also protocols, Drivers, Simulation Programming. In third part we should study Network Design, Protocols designs and analysis considering deterministic and non-deterministic approach. We expect natural thinking from student. For example he should able to consider different constraints and assume suitable data and solve the problems.</td>
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<td>Topic</td>
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<tr>
<td>1. Data Communications</td>
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<tr>
<td>3. Introduction to Transmission Technologies</td>
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<td>4. Optical Networking</td>
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<tr>
<td>6. Common Protocols and Interfaces in the LAN environment</td>
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<td>7. Frame Relay</td>
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<td>9. Common Protocols and Interfaces in the Upper Layers(TCP/IP)</td>
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<tr>
<td>11. Requirements Definition</td>
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<tr>
<td>12. Traffic Engineering and Capacity planning</td>
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<tr>
<td>15. Backbone Network Design</td>
</tr>
</tbody>
</table>

**Text Books:**
- Darren L Spohn, "Data Network Design", TMH
- D. Bertsekas, R. Gallager, "Data Networks", PHI

**References:**
- W.R. Stevens, "Unix Network Programming", Vol.1, Pearson Education
- J.Walrand, P. Varaiya, “High Performance Communication Networks”, Morgan Kaufmann
- A.S. Tanenbaum, “Computer Networks”

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering all the topics of the syllabus.
**OBJECTIVES OF THE COURSE:** Learn about the threats in computer security. Understand what puts you at a risk and how to control it. Controlling a risk is not eliminating the risk but to bring it to a tolerable level.

**DETAILED SYLLABUS**


2. **Program Security:** Secure programs: Fixing Faults, Unexpected Behaviour, Types of Flaws. **Non-malicious program errors:** Buffer overflows, Incomplete Mediation. **Viruses and other malicious code:** Why worry about Malicious Code, Kinds of malicious code, How viruses attach, How viruses gain control, Prevention, Control Example: The Brain virus, The Internet Worm, Web bugs. **Targeted malicious code:** Trapdoors, Salami Attack. **Controls against program threats:** Development Controls, Peer reviews, Hazard Analysis.


4. **Database Security:** Security requirements- Integrity of Database, Confidentiality and Availability, Reliability and integrity, Sensitive data, Interface, Multilevel database, Proposals for multilevel security


6. **Legal, Privacy, and Ethical Issues in Computer Security:** Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime, Privacy, Ethical issues in computer society, Case studies of ethics

**Text Books:**


**References:**

1. Whitman, Mattord, “Principles of information security”, Thomson
Objectives of the course: Learn about the threats in Network and Internet security. Understand what puts you at a risk and how to control it. Controlling a risk is not eliminating the risk but to bring it to a tolerable level.

DETAILED SYLLABUS


2. **Elementary Cryptography:** Terminology and Background, Cryptography and network security. Concepts of Encryption and Decryption. Cryptanalysis, Substation Cipher. Transpositions Good and Secure Encryption Algorithm. Trust worthy Encryption systems Data encryption standards (DES) and Advanced Encryption Standards (AES) Comparison of DES and AES.

3. **Classical Encryption Technique:** Symmetric and Asymmetric Encryption Systems, Stream and Block Ciphers, Contemporary Symmetric Ciphers, Confidentiality using Symmetric Encryption.


Text Books:

4. Firewalls and Internet Security by William R. Cheswick, Steven M. Bellovin, Aviel D. Rubin

References:


Assignments: 10 assignments covering the syllabus has to be submitted
Introduction
Growth of Computer Networking, Complexity in Network Systems, Mastering the Complexity, Resource Sharing, Growth of the Internet, Probing the Internet, Interpreting A Ping Response

PART I DATA TRANSMISSION

Transmission Media
Copper Wires, Glass Fibers, Radio, Satellites, Geosynchronous Satellites, Low Earth Orbit Satellites, Low Earth Orbit Satellite Arrays, Microwave, Infrared, Light Form a Laser

Local Asynchronous Communication
The Need for Asynchronous Communication, Using Electric Current to Send Bits, Standards for Communication, Baud Rate, Framing, and Errors, Full Duplex Asynchronous Communication, Limitations of Real Hardware, Hardware Bandwidth and the Transmission of Bits, The Effect of Noise On Communication, Significance for Data Networking

Long-Distance Communication (Carriers, Modulation and Modems)
Sending Signals across Long Distances, Modem Hardware Used for Modulation and Demodulation, Leased Analog Data Circuits, Optical, Radio Frequency, And Dialup Modems, Carrier Frequencies and Multiplexing, Base band And Broadband Technologies
Wave Division Multiplexing, Spread Spectrum, Time Division Multiplexing

PART II PACKET TRANSMISSION

Packets, Frames and Error Detection
The Concept of Packets, Packets and Time-Division Multiplexing, Packets and Hardware Frames, Byte Stuffing, Transmission Errors, Parity Bits and Parity Checking, Probability, Mathematics And Error Detection, Detecting Errors With Checksums, Detecting Errors With Cyclic Redundancy Checks, Combining Building Blocks, Burst Errors, Frame format And Error Detection Mechanisms

LAN Technologies and Network Topology
Direct Point-To-Point Communication, Shared Communication Channels, Significance of LANs and Locality of Reference, LAN Topologies, Bus Network: Ethernet Carrier Sense on Multi-Access Networks (CSMA), Collision Detection and Back off With CSMA/CD, Wireless LANs And CSMA/CA, Bus Network: Local Talk

Hardware Addressing and Frame Type Identification
Specifying a Recipient, How LAN Hardware Uses Addresses to Filter Packets Format of a Physical Address, Broadcasting, Multicasting, Multicast Addressing, Identifying Packet Contents, Frame Headers And Frame Format, Using Networks That Do Not Have Self-Identifying Frames, Network Analyzers

LAN Wiring, Physical Topology, and Interface Hardware
Speeds of LANs and Computers, Network Interface Hardware, the Connection between A NIC and A Network, Original Thick Ethernet Wiring, Connection Multiplexing, Thin Ethernet Wiring Twisted Pair Ethernet, the Topology Paradox, Network Interface Cards and Wiring Schemes,

Extending LANs: Fiber Modems, Repeaters, Bridges and Switches
Distance Limitation and LAN Design, Fiber Optic Extensions, Repeaters, Bridges, Frame Filtering Startup and Steady State Behavior of Bridged Networks, Planning a Bridged Network, Bridging Between Buildings, Bridging Across Longer Distances, A Cycle Of Bridges, Distributed Spanning Tree, Switching, Combining Switches And Hubs, Bridging And Switching With Other Technologies

Long-Distance Digital Connection Technologies
Digital Telephony, Synchronous Communication, Digital Circuits and DSU, Telephone Standards
DS Terminology and Data Rates, Lower Capacity Circuits, Intermediate Capacity Digital Circuits
Highest Capacity Circuits, Optical Carrier Standards, the C Suffix, Synchronous Optical Network (SONET), the Local Subscriber Loop, ISDN, Asymmetric Digital Subscriber Line Technology
Other DSL Technologies, Cable Modem Technology, Upstream Communication, Hybrid Fiber Coax

**Wan Technologies and Routing**
Large Networks and Wide Areas, Packet Switches, Forming A WAN, Store and Forward Physical Addressing In A WAN, Next-Hop Forwarding, Source Independence, Relationship of Hierarchical Addresses to Routing, Routing In A WAN, Use of Defaults Routes, Routing Table Computation, Shortest Path Computation in a Graph, Distributed Route Computation, Distance Vector Routing

**Network Ownership, Service Paradigm, and Performance**
Network Ownership, Virtual Private Networks, Service Paradigm, Connection Duration and Persistence, Examples of Service Paradigms, Addresses and Connection Identifiers, Network Performance Characteristics

**Protocols and Layering**
The Need for Protocols, Protocol Suites, A Plan for Protocol Design, the Seven Layers, Stacks: Layered Software, How Layered Software Works, Multiple, Nested Headers, the Scientific Basis for Layering,

**TERM WORK**
Term work should consist of at least 10 assignments from the aforementioned topics. A Seminar to be presented by each student as part of term works carrying 15 marks.

**REFERENCE**
Computer Network, Tuekeun, PHI
Networking Technology, Jaiswal, Galgotia.
Data Networking, Bertsekas, PHI
Computer Networks and Internets, Douglas E. Comer  Pearson Education Asia

<table>
<thead>
<tr>
<th>CLASS: M. Sc (Computer Science)</th>
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<tr>
<td>SUBJECT: SATELLITE COMMUNICATIONS (Elective-I)</td>
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<tr>
<td><strong>Lectures: 4 Hrs per week</strong></td>
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<tr>
<td><strong>Practical: 4 Hrs per week</strong></td>
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</table>

1. **Introduction:**
   General background, frequency allocations for satellite services, basic satellite system, system design considerations, applications.

2. **Satellite Orbits:**
   Introduction, laws governing satellite motion, orbital parameters, orbital perturbations, Doppler effects, geostationary orbit, antenna look angles, antenna mount, limits of visibility, Earth eclipse of satellite, sun transit outage, inclined orbits, sun-synchronous orbit, launching of geostationary satellites.

3. **Wave Propagation and Polarization:**
   Introduction, atmospheric losses, ionospheric effects, rain attenuation, other impairments, antenna polarization, polarization of satellite signals, cross polarization discrimination, ionospheric depolarization, rain depolarization, ice depolarization.

4. **Satellite Antenna:**
   Antenna basics, aperture antennas, parabolic reflectors, offset feed, double reflector antennas, shaped reflector systems.

5. **Link Design:**
   Introduction, transmission losses, link power budget equation, system noise, carrier to noise ratio for uplink and downlink, combined uplink and downlink carrier to noise ratio, inter modulation noise.
6. **Communication Satellites:**
Introduction, design considerations, lifetime and reliability, spacecraft sub systems, spacecraft mass and power estimations, space segment cost estimates.

7. **Earth Stations:**
Introduction, design considerations, general configuration and characteristics.

8. **Multiple Access Techniques:**
Introduction, FDMA, TDMA, FDMA/TDMA, operation in a multiple beam environment, CDMA, multiple access examples.

9. **Non Geostationary Orbit Satellite Systems:**
Introduction, reasons, design considerations, case study, example of systems.

**Term Work:**
1. Assignments covering the entire syllabus

**Text Books:**

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**CLASS: M. Sc (Computer Science)**

**SUBJECT: NEURAL NETWORKS & FUZZY SYSTEMS (Elective-I)**

<table>
<thead>
<tr>
<th>Lectures: 4 Hrs per week</th>
<th>Practical: 4 Hrs per week</th>
<th>Theory: 75 Marks</th>
<th>Term work / Practical: 25 Marks</th>
</tr>
</thead>
</table>

**Objective:** This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications. Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.

**DETAILED SYLLABUS**

1. **Introduction:** Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.
2. **Single Layer Perceptron:** Perceptron convergence theorem, Method of steepest descent - least mean square algorithms.
3. **Multilayer Perceptron:** Derivation of the back-propagation algorithm, Learning Factors.
5. **Simulated Annealing:** The Boltzmann machine, Boltzmann learning rule, Bidirectional Associative Memory.
6. **Fuzzy logic:** Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relations, Operations on fuzzy relations, The extension principle, Fuzzy measures, Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers.

**Text Books:**
1. Simon Haykin, “*Neural Network a - Comprehensive Foundation*”, Pearson Education
2. Zurada J.M., “*Introduction to Artificial Neural Systems*, Jaico publishers
4. Ahmad Ibrahim, “*Introduction to Applied Fuzzy Electronics*”, PHI

**References:**
1. Yegnanarayana B., “*Artificial Neural Networks*”, PHI

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
Defining the scope of multimedia, Hypertext and Collaborative research, Multimedia and personalised computing, Multimedia on the map, Emerging applications, The challenges

The convergence of computers, Communications, and entertainment products
The technology trends, Multimedia appliances, Hybrid Devices, Designers perspective, industry perspective of the future, Key challenges ahead, Technical, regulatory, Social

Architectures and issues for Distributed Multimedia systems
Distributed Multimedia systems, Synchronization, and QOS Architecture, The role of Standards, A frame work for Multimedia systems

Digital Audio Representation and processing
Uses of Audio in Computer Applications, Psychoacoustics, Digital representation of sound, transmission of digital sound, Digital Audio signal processing, Digital music making, Speech recognition and generation, digital audio and the computers

Video Technology

Digital Video and Image Compression
Video compression techniques, standardization of Algorithm, The JPEG Image Compression Standard, ITU-T Recommendations, The EPEG Motion Video Compression Standard, DVI Technology

Operating System Support for Continuous Media Applications
Limitation of Work station Operating system, New OS support, Experiments Using Real Time Mach

Middleware System Services Architecture
Goals of Multimedia System services, Multimedia system services Architecture, Media stream protocol

Multimedia Devices, Presentation Services, and the User Interface
Client control of continuous multimedia, Device control, Temporal coordination and composition, toolkits, hyper applications

Multimedia File systems and Information Models
The case for multimedia information systems, The file system support for continuous Media, Data models for multimedia and Hypermedia information, Content- based Retrieval of Unstructured Data

Multimedia presentation and Authoring
Design paradigms and User interface, barriers to wide spread use, research trends

Multimedia Services over the Public Networks
Requirements, Architecture, and protocols, Net work services, applications

Multimedia Interchange
Quick time Movie File Format, QMFI, MHEG (Multimedia and Hypermedia Information Encoding Expert Group), Format Function and representation, Track model and Object model, Real Time Interchange

Multimedia conferencing
Teleconferencing Systems, Requirements of Multimedia Communications, Shared Application Architecture and embedded Distributed objects, Multimedia Conferencing Architecture

Multimedia Groupware
Computer and Video fusion approach to open shared work place, High Definition Television and desktop computing, HDTV standards, Knowledge based Multimedia systems, Anatomy of an Intelligent Multimedia system

Text Book
Multimedia Systems by John F. Koegel Buford- Pearson Education
1. AI and Internal Representation
Artificial Intelligence and the World, Representation in AI, Properties of Internal Representation, The Predicate Calculus, Predicates and Arguments, Connectives Variables and Quantification, How to Use the Predicate Calculus, Other Kinds of Inference Indexing, Pointers and Alternative Notations, Indexing, The Isa Hierarchy, Slot-Assertion Notation, Frame Notation

2. Lisps
Lisps, Typing at Lisp, Defining Programs, Basic Flow of Control in Lisp, Lisp Style, Atoms and Lists, Basic Debugging, Building Up List Structure, More on Predicates, Properties, Pointers, Cell Notation and the Internals (Almost) of Lisp, Destructive Modification of Lists, The for Function ,Recursion, Scope of Variables, Input/Output, Macros

3. Neural Networks and Fuzzy systems
Neural and fuzzy machine Intelligence, Fuzziness as Multivalence, The Dynamical Systems approach to Machine Intelligence, The brain as a dynamical system, Neural and fuzzy systems as function Estimators, Neural Networks as trainable Dynamical system, Fuzzy systems and applications, Intelligent Behavior as Adaptive Model free Estimation, Generalization and creativity, Learning as change, Symbol vs Numbers, Rules vs Principles, Expert system Knowledge as rule trees, Symbolic vs Numeric Processing, Fuzzy systems as Structured Numerical estimators, Generating Fuzzy rules with product space Clustering, Fuzzy Systems as Parallel associators, Fuzzy systems as Principle based Systems

   Neural Network Theory
Neuronal Dynamics: Activations and signals, Neurons as functions, signal monotonicity, Biological Activations and signals, Neuron Fields, Neuron Dynamical Systems, Common signal functions, Pulse-Coded Signal functions

   Genetic Algorithms
A simple genetic algorithm, A simulation by hands, similarity templates(Schemata), Mathematical foundations, Schema Processing at work, The two- armed and k-armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem Computer implementation of Genetic algorithm, Data Structures, Reproduction , Cross over and Mutation, Time to reproduce and time to Cross Mapping objective function to fitness form, Fitness scaling
Applications of genetic algorithm, De Jong and Function Optimization, Improvement in basic techniques, Introduction to Genetics based machine learning, applications of genetic based machine learning

1. Data Mining : Introduction to Data Mining, Computer systems that can learn, Machine learning and methodology of science, Concept learning, Data ware house, designing decision support systems, Client server and data warehousing, Knowledge Discovery Process, Visualization Techniques, K-nearest neighbor, Decision trees, OLAP tools, Neural networks, Genetic algorithm, Setting up a KDD environment, Real life applications, Customer profiling, Discovering foreign key relationships

Assignments
10 assignments covering the syllabus has to be submitted

Text book
1. Introduction to Artificial Intelligence By Eugene Charniak, Drew McDermott- Addison Wesley
2. Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence by Bart Kosko- PHI
4. Data Mining by Pieter Adriaans and Dolf Zantinge – Pearson Education Asia
5. Data Warehousing in the Real World by Sam Analhory and Dennis Murray, Addison –Wesley
CLASS: M. Sc (Computer Science)

SUBJECT: IMAGE PROCESSING, Paper I, Term I

<table>
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<tr>
<th>Lectures: 4 Hrs per week</th>
<th>Theory: 75 Marks</th>
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<tr>
<td>Practical: 4 Hrs per week</td>
<td>Term work / Practical: 25 Marks</td>
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Objective: Digital Image Processing is a rapidly evolving field with growing applications in science and engineering. Image processing holds the possibility of developing the ultimate machine that could perform the visual functions of all living beings. There is an abundance of image processing applications that can serve mankind with the available and anticipated technology in the near future.

DETAILED SYLLABUS


3. Image Enhancement in the Spatial Domain: Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters


5. Wavelets and Multiresolution Processing: Image pyramids, Subband coding, Haar transform, Series expansion, Scaling functions, Wavelet functions, Discrete wavelet transforms in one dimensions, Fast wavelet transform, Wavelet transforms in two dimensions


7. Morphological Image Processing: Introduction, Dilatation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images

8. Image Segmentation: Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Region based segmentation

9. Image Representation and Description: Representation schemes, Boundary descriptors, Regional descriptors

Text Books:


References:


TERM WORK

1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
CLASS: M. Sc (Computer Science)

SUBJECT: DISTRIBUTED COMPUTING, Paper II, Term I

<table>
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<td>Term work / Practical: 25 Marks</td>
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Objective: This course aims to build concepts regarding the fundamental principles of distributed systems. The design issues and distributed operating system concepts are covered.

DETAILED SYLLABUS

1. Introduction to Distributed System: Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems.
4. Naming: Naming entities, Locating mobile entities, Removing un-referenced entities.
5. Synchronization: Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.
9. Distributed File System: Sun network file system, CODA files system.

Text Books:

References:

TERM WORK
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

CLASS: M. Sc (Computer Science)

SUBJECT: EMBEDDED SYSTEMS, Paper II, Term II

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<tr>
<td>Practical: 4 Hrs per week</td>
<td>Term work / Practical: 25 Marks</td>
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Objective: Embedded system tools and products are evolving rapidly. This course deals with various approaches to building embedded systems. It introduces unified view of hardware and software. The aim of this course is to make the students aware of the various applications of embedded systems.

DETAILED SYLLABUS

1. An overview of embedded systems: Introduction to embedded systems, Categories and requirements of embedded systems, Challenges and issues related to embedded software development, Hardware/Software co-design, Introduction to IC technology, Introduction to design technology
2. Embedded Software development: Concepts of concurrency, processes, threads, mutual exclusion and inter-process communication, Models and languages for embedded software, Synchronous approach to embedded system design, Scheduling paradigms, Scheduling algorithms, Introduction to RTOS, Basic design using RTOS
3. Embedded C Language: Real time methods, Mixing C and Assembly, Standard I/O functions, Preprocessor directives, Study of C compilers and IDE, Programming the target device
DEPARTMENT OF COMPUTER SCIENCE, UNIVERSITY OF MUMBAI

4. **Hardware for embedded systems:** Various interface standards, Various methods of interfacing, Parallel I/O interface, Blind counting synchronization and Gadfly Busy waiting, Parallel port interfacing with switches, keypads and display units, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above concepts using C language.

5. **Study of ATMEL RISC Processor:** Architecture, Memory, Reset and interrupt, functions, Parallel I/O ports, Timers/Counters, Serial communication, Analog interfaces, Implementation of above concepts using C language, Implementation of above concepts using C language.

6. **Case studies and Applications of embedded systems:** Applications to: Communication, Networking, Database, Process Control, Case Studies of: Digital Camera, Network Router, RTLinux.

**Text Books:**
1. Raj Kamal, "Embedded Systems", TMH
2. David E. Simon, "An Embedded Software Primer", Pearson Education

**References:**
2. Craig Hollabaugh, "Embedded Linux", Pearson Education
5. Myke Predko, "Programming and Customizing the 8051 Microcontroller", TMH

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
   - Four experiments on micro controller based systems.
   - Four experiments using cross C compiler and Linux.
   - Two experiments using developments tools like logic analyzer, emulator and simulator.
   - Two experiments on case study of advanced embedded systems.

**CLASS: M. Sc (Computer Science)**

**SUBJECT: PATTERN RECOGNITION (Elective - II), Paper IV, Term I**

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<tr>
<td>Practical: 4 Hrs per week</td>
<td>Term work / Practical: 25 Marks</td>
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**Objective:** This course teaches the fundamentals of techniques for classifying multi-dimensional data, to be utilized for problem-solving in a wide variety of applications, such as engineering system design, manufacturing, technical and medical diagnostics, image processing, economics, psychology.

**DETAILED SYLLABUS**

1. **Introduction:** Machine perception, Pattern recognition systems, Design cycle, Learning and Adaptation
2. **Bayesian Decision Theory:** Bayesian decision theory: Continuous features, Minimum-error rate classification, classification, Classifiers, Discriminant functions and Decision surfaces, Normal density, Discriminant functions for normal density, Bayes Decision theory: discrete features
3. **Maximum-Likelihood and Bayesian Parameter Estimation:** Maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation: Gaussian case and General theory, Problems of dimensionality, Hidden Markov Model
4. **Nonparametric Techniques:** Density estimation, Parzen windows, k-n-Nearest-Neighbor estimation, Nearest-Neighbor rule, Matrics and Nearest-Neighbor classification
5. **Linear Discriminants Functions:** Linear discriminant functions and decision surfaces, Generalised linear discriminant functions, 2-Category linearly separable case, Minimising the Perceptron criterion function, Relaxation procedure, Non-separable behavior, Minimum squared error procedure, Ho-Kashyap procedures, Multicategory generalizations
6. **Nonmetric Methods:** Decision tree, CART, ID3, C4.5, Gramatical methods, Gramatical
7. **Algorithm Independent Machine Learning**: Lack of inherent superiority of any classifier, Bias and Variance, Resampling for estimating statistic, Resampling for classifier design, Estimating and comparing classifiers, Combining classifiers

8. **Unsupervised Learning and Clustering**: Mixture densities and Identifiability, Maximum-Likelihood estimations, Application to normal mixtures, Unsupervised Bayesian learning, Data description and clustering criterion function for clustering, Hierarchical clustering

9. **Applications of Pattern Recognition**

**Text Books:**
2. Gose, Johnsonbaugh and Jost, “Pattern Recognition and Image analysis”, PHI

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

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**CLASS: M. Sc (Computer Science)**

**SUBJECT: COMPUTER VISION (Elective - II), Paper IV, Term II**

<table>
<thead>
<tr>
<th>Lectures: 4 Hrs per week</th>
<th>Practical: 4 Hrs per week</th>
<th>Theory: 75 Marks</th>
<th>Term work / Practical: 25 Marks</th>
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</thead>
</table>

**Objective:** To introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving

**DETAILED SYLLABUS**

1. **Recognition Methodology**: Conditioning, Labeling, Grouping, Extracting, Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.


4. **Region Analysis**: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.


6. **Object Models And Matching**: 2D representation, Global vs. Local features.

7. **General Frame Works For Matching**: Distance relational approach, Ordered- structural matching, View class matching, Models database organization.

8. **General Frame Works**: Distance –relational approach, Ordered –Structural matching, View class matching, Models database organization.


**Text Books:**

**References:**

**TERM WORK**
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
Real time computer graphics, Flight simulation, virtual environment, Benefits of virtual reality, Evolution of Virtual Reality, Historical perspective, scientific landmarks

3D Computer graphics
The virtual world space, positioning the virtual observer, the perspective projection, Human vision, Stereo perspective projection, 3D clipping, colour theory, simple 3D modelling, illumination models, shading algorithms, radiosity, hidensurface removal, realism, stereographic images

Geometric modelling
From 2D to 3D, 3D space curves, 3D boundary representation,

Geometrical Transformations
Frames of reference, Modelling transformations, instances, picking flying, Scaling the VE, Collision detection

A generic VR Systems
The virtual Environment, The computer environment, VR Technology, Modes of Interaction, VR systems

Animating the Virtual Environment
Dynamics of numbers, the animation of objects, shape and object inbetweening, free-form deformation, particle systems

Physical Simulation
Objects falling in a gravitational field, rotating wheels, Elastic collisions, Projectiles, simple pendulums, springs, flight dynamics of an aircraft

Human factors
The eye, The ear, the somatic senses, Equilibrium

Virtual Reality Hardware
Sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR Systems

Virtual Reality Software
Modelling Virtual worlds, Physical simulation, VR tool kits

Virtual Reality Applications
Engineering, Entertainment, science, Education, training, Future Virtual environment, Modes of Interaction

Text Books
Virtual Reality Systems John Vince- Pearson Education Asia
methods, Arrays Strings and Vectors, Interfaces, Packages, Multi-Threading, managing errors and exceptions, Applet programming, Managing files and streams

**Java Technology for Active Web Documents**
An Early Form of Continuous Update, Active Documents and Server Overhead, Active Document Representation and Translation, Java Technology, the Java Run-Time Environment, The Java Library A Graphics Toolkit, Using Java Graphics on a Particular Computer, Java Interpreters and Browsers Compiling a Java Program, Invoking an Applet, Example of Interaction with a Browser

**RPC and Middleware**
Programming Clients and Servers, Remote Procedure Call Paradigm, RPC Paradigm, Communication Stubs, External Data Representation, Middleware and Object-Oriented Middleware

**Network Management (SNMP)**
Managing an Internet, The Danger of Hidden Features, Network Management Software, Clients, Servers, Managers and Agents, Simple Network Management Protocol, Fetch-Store Paradigm, The MIP and Object Names, The Variety of MIB Variables, MIB variables that correspond to arrays

**Java technologies**
Graphics, JFC-JAVA foundation classes, swing, images, java 2d graphics, internationalization, Communication and Networking, TCP Sockets, UDP Sockets, **java.net**, java security, Object serialization, Remote method serialization, JDBC: Java Data Base Connectivity, Java beans, Java interface to CORBA, JAVA- COM Integration, Java Media Framework, commerce and java wallet, Data structures and java utilities, JavaScript, Servelets

**TERM WORK**
Term work should consist of at least 06 assignments including debugged java source code for the applications from the aforementioned topics. A Seminar to be presented by each student as part of term work carrying 15 marks.

**REFERENCE**
Using JAVA 2, Joseph L weber, PHI
JAVA 2 complete, Sybex, BPB
Java2 The complete Reference, Patrick Naughton, T M H
Computing concepts With JAVA2, Cay Horstmann, WILEY
JSP Java Server Pages, Barry Burd, IDG Books India(p) Ltd
Java2 Programming Bible, Aaron Walsh, IDG Books India(p) Ltd
Java2, swing, servlets, JDBC & JAVA Beans Programming Black Book Steven Holzner dreamtech press

**CLASS: M. Sc (Computer Science)**
**SUBJECT: Bioinformatics (Elective)**

<table>
<thead>
<tr>
<th>Periods per week 1Period is 50 minutes</th>
<th>Lecture</th>
<th>TW/Practical</th>
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<tr>
<th>Evaluation System</th>
<th>Hours</th>
<th>Marks</th>
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<tbody>
<tr>
<td>Theory Examination</td>
<td>3</td>
<td>100</td>
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<tr>
<td>TW/Tutorial/Practice</td>
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**Overview**

*Information networks- Protein information resources-Genome Information resources- DNA Sequence analysis- pair wise alignment techniques-multiple sequence alignment-Secondary database searching-building a sequence search protocol*

*Introduction*
The biological sequence structure deficit- Genome Projects-pattern recognition and prediction –the role of chaperones-sequence Analysis-Homology and analogy.

**Information Networks**


**Protein Information resources**

*Biological Data Bases-Primary sequence Databases-Composite Protein sequence databases-Secondary databases- Composite Protein pattern databases-structure classification databases-web addresses*  

**Genome Information resources**

DNA Sequence Analysis  
Pairwise alignment Techniques  
Multiple sequence alignment  
Secondary database searching  
Building a sequence search Protocol  
Analysis packages

**Term Work**

10 assignments covering the entire syllabus
CLASS: M. Sc (Computer Science)

SUBJECT: INTELLIGENT SYSTEMS (Elective - II), Paper IV, Term II

Lectures: 4 Hrs per week
Practical: 4 Hrs per week

<table>
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<tr>
<th>Theory: 75 Marks</th>
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<tr>
<td>Term work / Practical: 25 Marks</td>
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Objectives: To understand and apply principles, methodologies and techniques in design and implementation of intelligent system.

DETAILED SYLLABUS

2. Intelligent Agents: How agent should act, Structure of intelligent agents, Environments
3. Problem Solving: Solving problems by searching, Informed search methods, Game playing
4. Knowledge and Reasoning: A knowledge based agent, The wumpus world environment, Representation, Reasoning, Logic, Proportional logic, First order logic: Syntax and Semantics, Extensions and Notational variation, Using first order logic
5. Building a Knowledge Base: Properties of good and bad knowledge base, Knowledge engineering, General ontology
6. Interfacing First Order Logic: Interface rules involving quantifiers, An example proof, Forward and backward chaining, Completeness
7. Acting Logically: Planning, Practical planning: Practical planners, Hierarchical decomposition, Conditional planning
8. Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief networks, Inference in belief networks
10. Agents that Communicate: Communication as action, Types of communicating agents, A formal grammar for a subset of English
11. Expert system: Introduction to expert system, Representing and using domain knowledge, Expert system shells, Explanation, Knowledge acquisition
12. Applications: Natural language processing, Perception, Robotics

Text Books:

References:
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, TMH
4. Ivan Brakto, “Prolog Programming for Artificial Intelligence”, Pearson Education

TERM WORK
1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
CLASS: M. Sc (Computer Science)

<table>
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<tr>
<th>OPTIMIZATION (Elective)</th>
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<td>Perid Periods per week</td>
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<td>Hours Marks</td>
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Evaluation System

Detailed Syllabus

INTRODUCTION
Need for optimization and historical development classification and formulation of optimization problem, Classical optimization methods, Calculus based methods, Enumerative schemes, Random search algorithms, Evolutionary algorithms.

Formulation of Primary and Subsidiary design equations, Limit equations and Normal redundant and incompatible specification.

Exact and Interactive techniques. Optimal design of elements and systems, shafts, gears, bearings, High-speed machinery, cams etc.

Linear Programming model
Formulation, objective function, constraints, decision variables, canonical and standard forms, parameters and variables, classical problems such as crew scheduling, Knap sack, napkin/caterer, product mix etc.

Graphical method for two variable problems, simplex algorithm and tabular representation, types of solution such as feasible / non feasible, degenerate / non degenerate, optimal / sub optimal, unique / alternate / infinite optimal, bounded / unbounded value and solution and their interpretations from simplex table, cycling phenomena, mutual solution of problems involving upto three iterations.

Duality concept, dual problem formulation, dual simplex method, primal sub optimal - dual not feasible, and other primal - dual relations, interpretation of dual variables. Duality Properties, sensitivity analysis for variation of parameter at a time.

Transportation, Transshipment and Assignment models. As special cases of LP model, Problem formulation and optimality conditions in Vogel’s penalty and Hungarian methods of solution. traveling salesman problem as a special case of assignment problem, sensitivity analysis manual solution of problems involving upto three iterations.

Integer LP Models
Gomary’s Cutting plane algorithms, branch and bound technique for integer programming

Simulation Models
Monte Carlo or experimenting method based on Probabilistic behavior data and random numbers, application in Probabilistic real life problems

TERM WORK:
10 Assignments covering the entire syllabus.

TEXT BOOKS:

REFERENCE BOOKS:
  Optimization for Engineering Design by Deb & Kalyanway.
  Optimization Methods by Mital K.V
  Operation Research - An Introduction by H.A. Taha.
  Statistical Distribution in Engineering by Karl Bury.
  Artificial Intelligence Through Simulated Evolution by Foged, Owence and Walsh.
  Conference proceedings – Annual conference on Evolution programming.
1. **Introduction to CRM**: what is a customer? How do we define CRM? CRM technology, CRM technology components, customer life style, customer interaction.

2. **Introduction to eCRM**: difference between CRM & eCRM, features of eCRM.

3. **Sales Force Automation (SFA)**: definition & need of SFA, barriers to successful SFA, SFA: functionality, technological aspect of SFA: data synchronization, flexibility & performance, reporting tools.

4. **Enterprise Marketing Automation (EMA)**: components of EMA, marketing camping, planning & management, business analytic tools, EMA components (promotions, events, loyalty & retention programs), response mgmt.

5. **Call Centers Mean Customer Interaction**: the functionality, technological implementation, what is ACD(automatic call distribution), IVR(interactive voice response), CTI(computer telephony integration), web enabling the call center, automated intelligent call routing, logging & monitoring.

6. **Implementing CRM**: pre implementation, kick off meeting, requirements gathering, prototyping & detailed proposal generation, development of customization, Power User Beta Test & Data import, training, roll out & system hand off, ongoing support, system optimization, follow up.

7. **Introduction to ASP (application service provider)**: who are ASP’s?, their role & function, advantages & disadvantages of implementing ASP.

**References**:

1. CRM at the speed of light by Paul Greenberg, TMH.
2. Customer R elations Management by Kristin Anderson & Carol Kerr. TMH.

**Term work**

10 assignments covering the entire syllabus.
CLASS: M. Sc (Computer Science)

<table>
<thead>
<tr>
<th>Project I (I year) and II (II Year)</th>
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<td>Periods per week</td>
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<td>Practical</td>
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<td>Tutorial</td>
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<td>Project</td>
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<td>Examination</td>
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Guidelines for submission of report of Project I and II

**Body of Project**

- Introduction
- Literature Survey
- Objective
- Methodology
- Feasibility study
- Design/synthesis/Analysis
- Fabrication and Details
- Drawings
- Test set up and Tests
- Results
- Case Study
- Results / Discussion
- Conclusion
- Future work
- References

**Appendix**

This should contain Drawings, Graphs, coding used etc.